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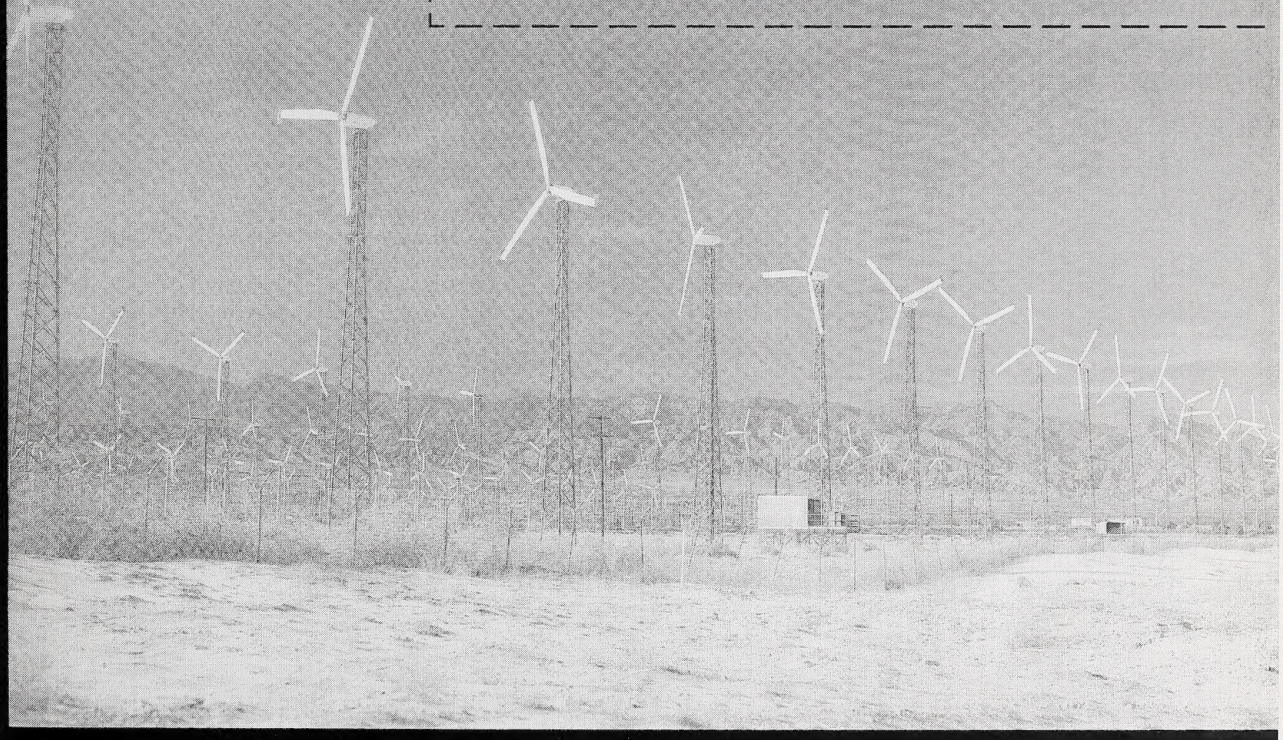
SCIENCE 7

Module 2 Plants for Food and Fibre

Home Instructor's Guide and Assignment Booklet 2A



Learning Technologies Branch

Alberta LEARNING

Science 7
Module 2: Plants for Food and Fibre
Home Instructor's Guide and Assignment Booklet 2A
Learning Technologies Branch
ISBN 0-7741-2409-1

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The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Home Instructor's Guide and Assignment Booklet.

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	✓
General Public	
Other	

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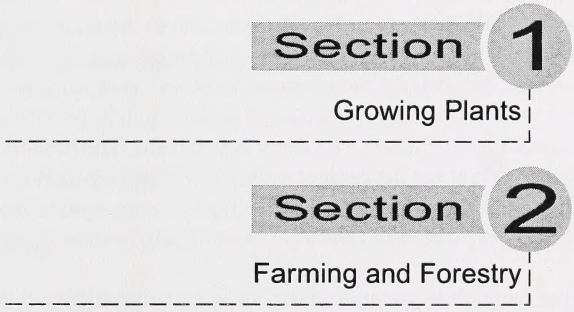
Module 2: Plants for Food and Fibre

The main emphasis of this module is **Science and Technology**.

The Science and Technology emphasis lends itself to a practical problem-solving approach to this module. The student's background knowledge of plants is most likely based upon his or her use of plants for food. Beyond using plants as food, however, the student is likely unaware of the many other ways humans have used plants and will need to use plants in the future. This module will take the student beyond seeing plants as simply food.

The need to control and protect plant growth for desired outcomes have led to many technological strategies that are studied in this module. After studying the basic parts and processes in plants, the student is introduced to strategies used by both agriculturalists and foresters that improve plant growth and meet consumer needs. Next, the student examines the short- and long-term impacts of these strategies on the environment, as well as the suitability of these strategies to sustain the ongoing use of plants for food and fibre well into the future.



Materials and Apparatus

A list of materials and apparatus needed to complete each module is given on page 10 of each Student Module Booklet. These materials and apparatus are also listed in the information specific to each module given later in this document. In planning ahead for your role, you will find it useful to preview these lists.

For an appreciation of the context in which the materials and apparatus are to be used, scan the activities and investigations in the lessons of the Student Module Booklets and on the referenced pages in the textbook. Any materials or apparatus needed for the optional "Going Further" items throughout the Student Module Booklet are not included in these lists.

Safety goggles and rubber gloves are generally advised when doing activities or investigations involving the manipulation of apparatus and materials.

Assessment

In this module, students are expected to complete two section assignments and a final module assignment. Their grading in this module is based on the assignments they submit. The mark distribution is as follows:

Assignment Booklet 2A	
Section 1 Assignment	**55 marks**
Assignment Booklet 2B	
Section 2 Assignment	**44 marks**
Final Module Assignment	**46 marks**
TOTAL	**145 marks**

Section 1: Growing Plants

This section contains three lessons. The first lesson is an introduction to the many ways humans use plants. The most familiar way known to most students is for food. The student learns not only to identify the consumption of plants, such as fruits and vegetables, but also the development of other foods, such as margarine and chocolate from plant parts. He or she then goes on to study other uses of plants, such as for fibre, medication, transportation, and fuel. Note that the student may think of fibre as a dietary supplement. The definition, in this case, needs to be clarified. The main thrust of this lesson is for the student to recognize the importance of plants to everyday lives of humans, both now and in the future. Lesson 1 ends with an inquiry investigation into the main needs of plants. The student carries out a week-long experiment to see what plants really need to grow.

The second and third lessons put technology on hold as they introduce the student to the plant as an organism in general. The second lesson discusses the main structures of plants and their specific functions, as well as adaptations that these structures can acquire in various conditions. This lesson also outlines basic plant processes necessary for survival, such as photosynthesis, diffusion, osmosis, respiration, and transpiration. To see how these processes basically work, the student will conduct find out activities. A general knowledge of these structures, functions, and processes is necessary to understand how and why technologies have been developed the way they have in the growth of plants for food and fibre.

The final lesson in this section deepens the student's understanding of the plant as an organism by introducing the student to plant reproduction and breeding. The practices of genetic modification and selective breeding are discussed to show the student how plant varieties can be developed. The differences between sexual and asexual reproduction are then introduced before an in-depth study of these processes is carried out. Various ways to produce plants asexually are examined. The student is then introduced to a typical seed plant's lifecycle and the parts that are necessary to carry out germination, growth, and fertilization. This section concludes with the student conducting another week-long investigation that examines germination conditions.

The following materials are needed for this section:

Section 1: Lesson 1

- thumbtack
- graduated cylinder
- ruler
- thermometer
- mung bean seeds (or pea seeds or red kidney bean seeds)
- paper towel
- paper cups (or small pots)
- potting soil (or garden soil)
- water

Section 1: Lesson 2

- trowel (or small shovel)
- dandelion (with roots, leaves, stem, and flower)
- ruler
- magnifying glass
- scissors
- water
- blue food colouring
- carrot (with leaves intact)
- 250-mL beaker
- table knife
- scale
- 500-mL beaker
- celery stalk (with leaves)
- water

Section 1: Lesson 3

- dried lima beans
- water
- jar (or glass)
- magnifying glass
- large sheets of paper
- felt pens

Special Considerations and Comments

Inquiry Investigation: Growing Conditions for Healthy Plants

This is quite a lengthy investigation requiring 4 to 6 days of prelab preparation. The student can begin the prelab preparation before working through Lesson 1. Mung bean seeds are suggested for use in this and other investigations, but other seeds will work as well. (See the materials list.) The student is required to complete a data table of his or her prelab preparation. Try to germinate ten seeds or so to ensure that at least six are successful and are able to be used in the investigation.

Be sure students read through the investigation in its entirety before carrying out the procedure. The student may need close supervision to be sure each pot is receiving the right amount of water and light and that the variables are being manipulated as required. Have the student record all observations in a labelled data table.

Section 1: Lesson 3

Find Out Activity: Inside Seeds

The seeds must be soaked overnight to be soft enough to break open.

Suggested Answers

Section 1: Lesson 1

10. Answers will vary. Sample variables are given.

    Variables:

    MV: amount of light, fertilizer, or water; the growth temperature (only 1)

    RV: height, total length, or root length of seedlings; the root mass or total mass of the seedlings (only 1)

    CV:
    - any of the variables listed as MVs that you did not choose as your MV
    - the amount and type of soil
    - the type of seed
    - the number of seeds in each pot
    - the length of time the seed is soaked
    - the period of growth
    - the compaction (how hard it is packed) of the soil

11. Answers will vary. A sample answer is given.

    How does the amount of light affect the height of seedlings?

12. If you increase the amount of light, the height of the seedlings will increase because photosynthesis requires light to provide energy for plant growth.

Note: Here is an outline of a good hypothesis. Students can use it almost like a formula.

If you _____ *(increase, decrease, or change)*
the _____ *(manipulated variable)*,
the _____ *(responding variable)*
will _____ *(increase, decrease, remain the same, change, or any of the combination of these)*
because _____ *(explain your prediction)*.

13. Answers will vary. The procedure must be a step-by-step list that meets all the requirements set out in Section 2: Lesson 1. Sample steps follow.

Procedure

Steps to determine how the amount of light affects the growth of seedlings (as measured by average seedling height) are as follows:

step 1: Prepare a table to record the height of the seedlings each day. Allow room to record the difference in height for each seedling at the end of the week. Allow room for the average change in height for each group of seedlings.

step 2: Make three groups of three seedlings each.

step 3: Fill the three pots with the same type of soil moisture.

step 4: Plant one group of three seedlings in each pot.

step 5: Number each seedling by putting a mark on the pot. This lets you follow the growth of each seedling individually.

Repeat steps 6 to 11 each day for a week.

step 6: Water the soil just enough to moisten the soil, but not enough to waterlog it. Follow with daily watering.

step 7: Measure the height of each seedling after the daily watering.

step 8: Place the pots under a bright light.

step 9: Place the group 1 pot in a dark cupboard after 8 hours.

step 10: Place the group 2 pot in the dark cupboard after 10 hours.

step 11: Place the group 3 pot in a dark cupboard after 12 hours.

step 12: After the seventh day, find the increase in height for each seedling. Record this in the table.

step 13: From the increase in seedling heights, calculate the average increase for each group. Record this in the table.

14. **Textbook questions 2, 3, and 4 of "Evaluate," p. 102**

    2. Not all seeds will germinate. Soaking and germinating reduces the wait time for results and ensures that you will have a sample of at least three seedlings for each condition. It is impossible to measure plant growth until the seeds sprout.

    3. Results will vary. Usually, the plant with more light, warmth, and water will have grown the best.

    4. Tall seedlings are not necessarily healthy. For example, seedlings grown in the dark put all their energy into length in an effort to find life-sustaining light. They are very pale and unhealthy. Healthy plants have a deep, full root system; a uniform green colour; many large leaves (relative to plant type and age); and strong stems.

15. Answers will vary. A sample conclusion is given.

    The longer the seedlings were in the light, the taller they grew.

Note: When the student writes his or her conclusion, they should consider and, as necessary, deal with four things:

(1) Give an answer to the question using his or her MV and RV.

(2) If there are other relevant conclusions coming from the data and analysis, give them as well.

(3) If the conclusion(s) does not agree with the student's hypothesis, he or she should try to explain why.

(4) If the investigation is being done as part of a larger study, the student should explain how his or her findings relate to the larger topic, situation, or study.

Section 1: Lesson 2

1. **Textbook questions 1, 2, and 3 of "What Did You Find Out?," p. 104**

    1. Answers will vary depending on current background knowledge. The roots are for absorbing water and nutrients as well as for anchoring the plant. The stem is for carrying water and food the plant produces. The leaves are for photosynthesis and transpiration. Flowers contain the reproductive structures.

    2. The main root of the dandelion plant is very long, allowing it to reach deep into the soil and achoring it very firmly.

    3. There are many possible answers. Other plants may have more or fewer flowers. Flowers may have different colours. Stems may be thicker or even made of wood. Root structures may vary. Rather than one main root, the root system may be shallow and made up of many similar-sized roots. Rain forest plants could be very large as long as there are lots of nutrients and water. In a nutrient-poor habitat, like a bog, plants may have adaptations for catching and digesting insects. Plants may also have adaptations, like a bad taste or smell, poisonous parts, thorns, or fast growth patterns, to discourage pests.

Section 1: Review

1. a. **Textbook questions 1 and 3 of "Reviewing Key Terms," p. 131**

    1. a. **Transpiration** is the loss of water from a plant by evaporation.

        b. The large, single root in a plant is called the **taproot**.

        c. **Osmosis** is a type of diffusion that occurs when two solutions are separated by a barrier through which only some materials can pass.

        d. **Fibre** is the tissue of plants from the stem, leaves, seeds, or roots.

        e. In **selective breeding**, a grower chooses and breeds plants with particular characteristics.

        f. Layering is a form of **asexual** reproduction.

    3. **Osmosis** is how water moves into and through a plant. It is the name for **diffusion** of water. The **root hairs** increase the surface area of the roots, through which water and nutrients can be absorbed from the soil. **Transpiration** is the process that pulls water up the stem to the leaves. The water absorption in the root hairs pushes the water up the stem.

    b. **Textbook questions 4, 5, 6, 7, and 9 of "Understanding Key Concepts," p. 131**

    4. Functions of the four main parts of a plant are as follows

        - roots
          – absorb water and nutrients
          – anchor the plants in soil

- stem
  - pathway for the movement of water and food
  - support the other parts of the plant

- leaves
  - provide a large surface area to carry out photosynthesis, and allow water and oxygen to exit the plant
  - take in carbon dioxide through the stomata

- flowers/cones
  - contain reproductive structures
  - attract pollinators, where the seeds form

5. Answers will vary. A sample answer is given.

   Plants grown in Alberta for food include wheat, oats, canola, barley, beans, field corn, sugar beets, lentils, alfalfa, legumes, and potatoes to name a few. Plants used for fibre are those such as lodgepole pines, white and black spruces, aspens, white birch, and tamarack. Different plants are harvested for their roots, stems, leaves, seeds, or fruit.

6. Plants can reproduce asexually with their stems (runners, layering, tubers, or rhizomes). They can reproduce from their roots (suckers). Humans can use asexual reproduction of plants by taking cuttings or by grafting.

7. Aboriginals have used plants for herbal medicines, wood to make canoes for transportation, moss for diapers, and clothing made from various fibres (such as from the bark of the western cedar).

9. Photosynthesis is the process by which plants make their own food in the form of sugar. Light energy is absorbed by the chlorophyll in the leaves of plants.

$$\text{carbon dioxide} + \text{water} + \text{light energy} \longrightarrow \text{sugar} + \text{oxygen}$$

2. The three stages of a plant's life cycle are

   - seed: where embryo is stored with a food source

   - seedling: the stage where the young plant grows very fast and begins to produce its own food by photosynthesis

   - adult: contains all reproductive structures necessary for seeds to be developed

3. Flowers and cones both have female parts (the ovules or eggs) and male parts (pollen).

4. Seeds can survive a long time without making their own food because they are dormant (inactive).

ASSIGNMENT BOOKLET 2A

Science 7
Module 2: Section 1 Assignment

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Teacher's Comments

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Teacher's Signature

Home Instructor: Keep this sheet when it is returned to you as a record of the student's progress.

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- Has your work been reread to be sure the spelling and details are correct?
- Is the record form filled out and the correct module label attached?

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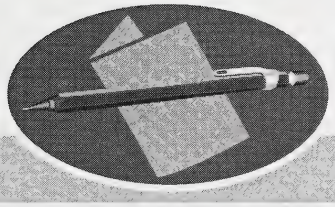
Science 7

Module 2

Plants for Food and Fibre

Assignment Booklet 2A



Learning Technologies Branch

Alberta LEARNING

FOR TEACHER'S USE ONLY

Summary

	Total Possible Marks	Your Mark
Section 1 Assignment	55	

Teacher's Comments

Science 7
Module 2: Plants for Food and Fibre
Assignment Booklet 2A
Learning Technologies Branch

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ASSIGNMENT BOOKLET 2A
SCIENCE 7: MODULE 2
SECTION 1 ASSIGNMENT

Your mark for this module will be determined in part by how well you do your assignments.

This Assignment Booklet is worth 55 marks out of the total 145 marks for the assignments in Module 2. The value of each assignment and each question is stated in the left margin.

Work slowly and carefully. If you have difficulty, go back and review the appropriate topic.

Be sure to proofread your answers carefully.

(55)

Section 1 Assignment: Growing Plants

Read all parts of your assignment carefully and record your answers in the appropriate places.

(7)

1. Create a data table for the growth factor you selected in "Investigation 2-B: Growing Conditions for Healthy Plants" on page 102 of the textbook. The data table should have places for the MV, RV, and any other required observations and data analysis. Be sure you meet all the requirements for a data table. (Review pages 475 and 476 of the textbook to see what needs to be in a data table.) As you do your investigation, fill in the table.

Return to page 24 of the Student Module Booklet and continue with Lesson 1.

(1) 2. a. Design Specification A of Investigation 2-B tells you how to plant your seeds. It is very clear that the seeds must be planted at the same depth. They are to be planted in the same soil and the same kind of container. Why are these conditions important?

_____

_____

(3) b. You tested one factor that could affect plant growth. What are three other factors that you could have tested?

_____

_____

_____

_____

Return to page 24 of the Student Module Booklet and continue with Lesson 1.

For questions 3 and 4, read each question carefully. Decide which of the choices BEST completes the statement or answers the question. Place your answer in the blank space given.

(1) _____ 3. People use many different substances. Plants play a role in much of human life. Which of the following shows plants being used?

A. A steelworker rivets two steel beams together.
B. A welder joins two pieces of pipe for a gas pipeline.
C. A nurse injects morphine into a post-operative patient.
D. A potter fires a clay urn in a kiln.

(1) _____ 4. Aspirin™ is now a manufactured product. Aboriginals used the same chemical from a natural source. A native plant that produces this chemical is

A. willow bark
B. potato leaves
C. fir needles
D. corn cobs

For question 5, decide if the final statement is true (T) or false (F). Place your answer in the blank space given.

(1)

_____ 5. Here is the description of a Norwegian wedding banquet:

> It will start with a dish of scallops and cured ham. Fried turbot with cauliflower puree will follow. For the main course, guests will be served lamb tenderloin with thyme sauce, new potatoes, and a selection of autumn vegetables. The dinner will be rounded off with a light goats cheese parfait with cloudberry coulis.

If there had never been plants, the guests would have gone hungry.

(4)

6. "Plants are a critical part of ecosystems." Describe four different ways plants play a positive and crucial role in the environment. Record your ideas in a point-form list.

_____

_____

_____

_____

_____

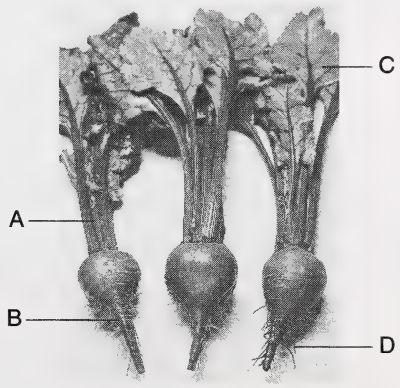
_____

Return to page 25 of the Student Module Booklet and begin Lesson 2.

7. Write your answers in the tables given.

(2)

a. Match the letters in the diagram with the name of the plant structure.



Plant Structure	Letter in Diagram
leaves	
root hairs	
stem	
taproot	

(4)

b. Match each function given with a plant structure. **Hint:** Some functions are shared by more than one plant structure.

(1) transpiration occurs
(2) a pathway for water
(3) exchange of gases occurs
(4) a pathway for nutrients
(5) anchors the plant
(6) photosynthesis takes place
(7) absorbs nutrients from the soil
(8) absorbs water from the soil
(9) a pathway for sugar
(10) supports other plant parts
(11) increases the surface area of the root

Plant Structure	Function Number
leaves	
root hairs	
stem	
taproot	

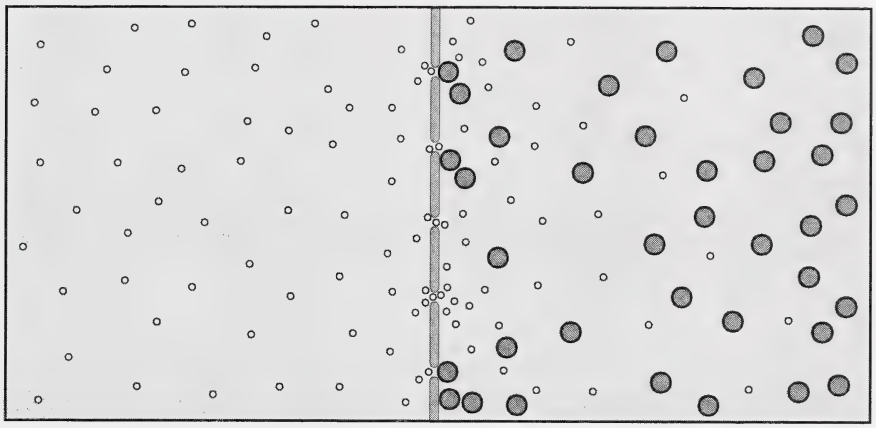
(2)

8. Many plants are hard to get rid of. There are several possible reasons in the following list. Which two items listed apply to dandelions?

A: adapted to one environmental niche
B: grow quickly
C: have many broad leaves
D: have many fine roots
E: use runners to reproduce

9. Use the diagram to answer the questions that follow.

Container with Contents Separated



(1) a. What structure is represented by the dashed line in the diagram?

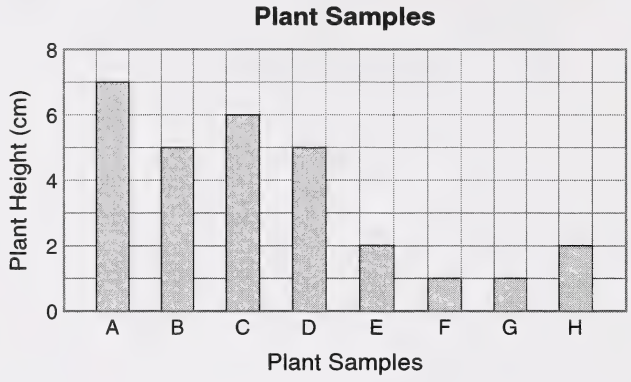
_____

(1) b. What process is taking place?

_____

10. Jenny conducted an experiment to find out about the basic needs of plants. She used sample groups with 3 plants in each. She measured and recorded plant growth for eight groups in all. One group was a control group. She changed one variable for each of the other groups. After 7 days, she used her results to create a bar graph to compare the samples.

A: watered to keep soil moist
B: kept at a warm temperature
C: kept under a grow light for 18 h/day
D: nutrients added to soil
E: kept at a cool temperature
F: kept in dark
G: grown in sand
H: control sample



(4) a. According to the graph, what are the four main needs of plants?

(1) b. In Jenny's experiment, what is the responding variable?

(3) c. Name three variables that need to be controlled in this experiment to make it fair?

(4)

11. Describe a root adaptation and a leaf adaptation that would be beneficial for a plant living in a cold, dry, windy, rocky, and steep environment with numerous herbivores. Explain why each adaptation would be beneficial for the plant. Be specific.

Read question 12 carefully. Decide which of the choices BEST answers the question. Place your answer in the blank space given.

(1)

_____ 12. A plant has a shallow spreading root system. It also has small spike-like leaves. Where is this plant most likely to be found growing?

A. a desert
B. a rain forest
C. a temperate grassland
D. a warm swamp

Return to page 35 of the Student Module Booklet and begin Lesson 3.

(2)

13. Explain, in your own words, how sexual and asexual reproduction of plants differ.

(6)

14. The lifecycle of a seed plant involves three different stages: seed, seedling, and adult. Place these names in the chart. Then list the letters of the information given next to the name of the stage that best suits it.

A: embryo
B: needs nutrients from soil to build newly developing parts
C: has ovaries and/or pollen
D: uses stored sugar in the form of starch for food
E: needs plenty of sunlight so it can create food for itself and for pollen production
F: characterized by flowers or cones
G: has a protective outer layer that is softened by water or animal digestive juices
H: must be created sexually
I: can be created asexually
J: chlorophyll starts to do its job

Name of Stage	Information About Stage

(2)

15. List two possible methods that could be used to produce large quantities of identical plants.

_____

_____

_____

_____

Return to page 50 of the Student Module Booklet and begin the Section 1 Review.

Read question 16 carefully. Decide which of the choices BEST answers the question. Place your answer in the blank space given.

(1)

_____ 16. A plant breeder wants to develop a new dahlia. Customers want a plant with large, showy flowers. The breeder has two different types of dahlias to start from. One has small showy flowers. The other has large, but simple, flowers. Which process is most likely to lead to the desired plant?

A. Cross-pollinate the two types.
B. Graft showy flower stems on the other type.
C. Graft the large-flowered type on the showy-type's roots.
D. Self-pollinate the showy plants.

(3)

17. Place the following names of the parts in the reproductive organs of plants in the appropriate column of the chart given.

- anther
- pollen
- stigma
- style
- ovary
- filament

Stamen: Male Reproductive Organ	Pistil: Female Reproductive Organ

Submit your completed Assignment Booklet 2A to your teacher for assessment.
Then return to page 51 of the Student Module Booklet and begin Section 2.

ASSIGNMENT BOOKLET DECLARATIONS

The Student's Declaration is to be signed by a student registered at the Alberta Distance Learning Centre. If the student is under 16, the Supervisor's Declaration is to be signed by the student's supervisor, who is usually a home instructor, teacher, or home-schooling coordinator. Failure to complete this page may invalidate the assignment results.

STUDENT'S DECLARATION

- I have followed the instructions outlined in the Student Module Booklet.
- I have completed the activities to prepare myself for the assignments in this Assignment Booklet.
- I completed the assignments in this Assignment Booklet by myself.

_____

Student's Signature

SUPERVISOR'S DECLARATION

I hereby certify that I have supervised the learning activities completed by _____.

Student's Name

I also certify that to the best of my knowledge the assignments in this Assignment Booklet were completed independently by this student.

_____

Supervisor's Signature

If you, the student or supervisor, have any comments or observations regarding this module, write them in the following space.

_____

_____

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